University of Asia Pacific
Department of Civil Engineering
Mid Semester Examination, Fall 2025
M.Sc. in Civil Engineering Program

Course Title: Advanced Design of Concrete Structures — Course Code: CE6108

Time: 1 hour — Credit Hour: 3.00 — Full Marks: 60

Answer all the questions

QUESTION 1 [30 MARKS]

A typical interior slab panel of an academic building (live load 2.9 kN/m^2) is shown in **Figure 1**. The floor will be constructed with flat slab (flat plate) and it carries 2 kN/m^2 dead load due to random wall and floor finishes. Thickness of the slab could be assumed using deflection (l_n/33) and punching shear requirements of flat slab. Column size could be assumed as 750 mm x 750 mm. **Apply** the concept to design the **long span column strip** of the slab for moment only. Assume required data to design the slab, concrete strength (f_c') could be used as 28 N/mm^2. [30 Marks]

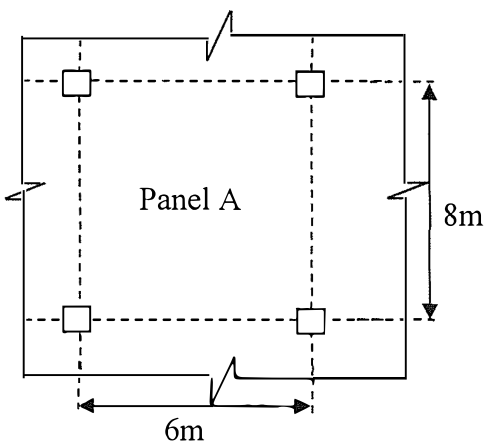

Figure 1. Panel of flat slab

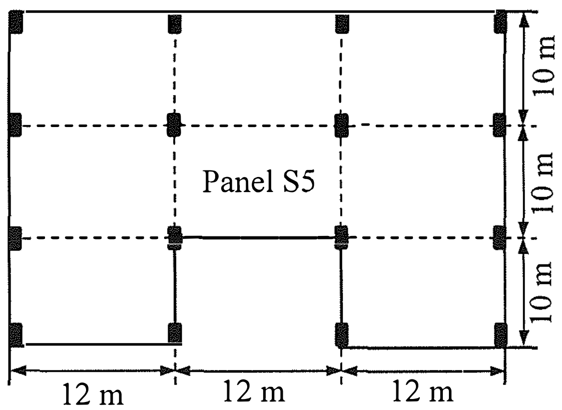

Figure 2. Waffle slab floor

QUESTION 2 [30 MARKS]

The floor system of an office building (live load 2.4 kN/m2) is required to be constructed with waffle slab as shown in **Figure 2**. The panels are supported with columns (600 mm x 900 mm). The floor carries 2 kN/m^2 dead load due to partition walls and finishes (excluding self-weight of slab). Propose optimal geometric properties of waffle (size and spacing of rib, thickness of slab) in accordance to BNBC 2020 considering deflection and punching shear requirements. Design the **column strip (long span)** of waffle for **Panel S5**. [30 Marks]

University of Asia Pacific
Department of Civil Engineering
Mid Semester Examination, Fall 2025
Program: M.Sc. in Civil Engineering

Course Title: Coastal Engineering | Course Code: MCE 6620
Time: 1 hour | Credit Hour: 3.00 | Full Marks: 30

Please keep your answers brief and succinct (directly to the point).

1) **Short Questions (5 X2 = 10 Marks):**
   a. A wave generated in deep ocean water travels toward the coast and eventually breaks on the beach. Briefly describe (in bullet points) the sequence of physical processes the wave undergoes from deep water to the shoreline.
   b. Classify the main types of wave breakers on beaches. For each type, sketch the breaking wave profile and describe two distinguishing physical characteristics.

2) **Mathematical problem (20 Marks):**
   A coastal community wants to assess total water level and flood risk under present-day conditions and with future sea level rise due to climate change. You're contracted to calculate and provide the following:
   a) Tidal Elevation: At a fixed shoreline location (x = 0), calculate tidal elevation for 24 hours at 4-hour intervals (t = 4, 8, 12, 24 hours).
   b) Plot the tidal levels from part (a) and calculate High and Low Tides values.
   c) Total Water Level: Calculate total water level (TWL) during a storm at high tide for: (i) present-day conditions and (ii) Future conditions with sea level rise.
   d) Increase in flood risk: ΔH = TWL_future - TWL_present

The following information is given as part of the contract assignment.

Tidal Constituents:

The community is located at a fixed point on the shoreline (x = 0). At this location, the tidal elevation varies only with time. This simplifies the general wave equation to $\eta = a\cos(\omega t)$.

Constituent		**Amplitude A (m)**	**Angular Frequency ω (rad/h)**
M_2	Principal lunar semi-diurnal	0.80	0.5059
S_2	Principal solar semi-diurnal	0.25	0.5236
K_1	Lunisolar diurnal	0.35	0.2625
O_1	Lunar diurnal	0.20	0.2433

Mean Sea Level (MSL): 2.50 m above chart datum.

Storm Event Conditions:

- Deep water wave height: H_0 = 2.0 m and Wave period: T = 10 s
- Beach slope: 1:20 (1 vertical: 20 horizontal)
- Storm surge (at high tide): 0.80 m

Future Climate Scenario (Year 2050):

- Projected Sea level rise: SLR = 0.40 m
- Tidal amplitudes, storm surge, and wave conditions remain unchanged.

Show all calculation steps. Round final answers to 2 decimal places.

***Note: For typical storm waves,* Wave Runup: $R_{2\%} = 6 \times H_0 \times \tan\beta$**

University of Asia Pacific
Department of Civil Engineering
Mid-Semester Examination Fall 2025
Program: M.Sc. in Civil Engineering

Course Title: Structural Dynamics I		Course Code: CE 6115
Time: 1 hour	Credit Hour: 3.0	Full Marks: 40

ANSWER ALL QUESTIONS. Any missing data can be assumed reasonably.

1. A single-degree-of-freedom (SDOF) system has mass $m = 2000$ kg, stiffness $k = 80{,}000$ N/m, and damping ratio $\zeta = 0.05$.Determine: (a) Natural circular frequency $\boldsymbol{\omega_n}$,(b) Damped natural frequency $\boldsymbol{\omega_d}$,(c) Critical damping coefficient $\boldsymbol{c_c}$ and (d) Actual damping coefficient $\boldsymbol{c}$. **[08]**

2. A weight w is suspended from a linear spring attached to the free end of a cantilever steel beam, as shown in Fig. 1. The beam has a length of 13 ft and a solid circular cross-section of 3 in. diameter. The modulus of elasticity of steel is $E = 29{,}000$ ksi, and the stiffness of the spring is $k = 15$ lb/in. The system is subjected to an external time-varying force $p(t)$ acting on the mass. **[10]**

Neglecting the mass of the beam and the spring, and assuming small deformations, derive the equation of motion of the system in terms of displacement measured from the static equilibrium position. In your derivation, clearly: Establish the static equilibrium condition, determine the equivalent stiffness of the system considering both the beam and the spring and formulate the governing differential equation using an appropriate free-body diagram.

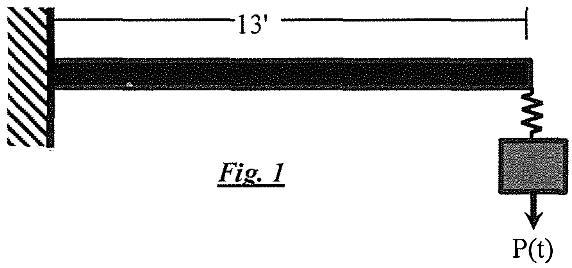

Fig. 1

3. A free vibration test is conducted on an elevated steel frame supporting a water tank. A horizontal force of 20 kips is applied at the top level, producing a lateral displacement of 2.5 in. The force is suddenly removed, and the structure undergoes free vibration. It is observed that after 5 complete cycles, the elapsed time is 2.5 s, and the amplitude reduces from 2.5 in. to 1.2 in. Determine: a) Damping ratio, b) Natural period of undamped vibration, c) Lateral stiffness of the structure, d)Total weight of the structure, e)Damping coefficient and f)The number of cycles required for the displacement amplitude to decrease to 0.3 in. **[12]**

If the weight of water required to fill the tank is 90 kips, determine the natural period of vibration and damping ratio of the structure when the tank is full, assuming that the damping coefficient remains unchanged.

4. A precision laboratory instrument weighing 120 lb is to be installed on a floor where the vertical vibration has an acceleration amplitude of 0.08 g at a frequency of 12 Hz. The instrument is supported on a rubber isolation pad with a stiffness of 60 lb/in and damping such that the damping ratio of the system is 8%. (a) Determine the acceleration transmitted to the instrument. (b) If the allowable acceleration for proper functioning of the instrument is limited to 0.004 g, suggest suitable modifications to the system. **[10]**

University of Asia Pacific
Department of Civil Engineering
Mid Term Examination (Fall 2025)
Program: M.Sc. Engineering (Civil)

Course Title: Principles of Earthquake Engineering
Credit Hour: 3.0
Time: 1 Hour

Course Code: CE 6701
Full Marks: 60

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1. Explain the mechanism of earth's interior layers responsible for global plate tectonic movements. What is elastic rebound theory? **(5+5=10)**

2. Describe different types of earthquake magnitude scales. What is magnitude saturation? **(6+4=10)**

3. Explain earthquake focus, epicenter, epicentral distance and fault with a sketch. How to measure the energy of an earthquake? **(8+2=10)**

4. Estimate the primary and shear wave velocity of a ground motion through earth's body having young's modulus of $6*10^{10}$ kPa, mass density of 1500 kg/m^3, and Poisson's ratio of 0.3. **(10)**

5. The Gutenberg-Richter earthquake recurrence model yields the following relationship for a hypothetical area source: **(10)**

$$\log_{10} \upsilon = 6 - 0.7M$$

Assuming that the earthquakes follow Poisson process, calculate:

(a) The probability that at least one earthquake of $M > 7$ will occur in 50-year and 100-year recurrence intervals.

(b) The probability that exactly one earthquake of $M > 7$ will occur in 50-year and 100-year recurrence intervals.

(c) The magnitude that would have a 15 % probability of exceedance in 65-year recurrence interval.

(d) The magnitude that would have a 2 % probability of exceedance in 65-year recurrence interval.

6. What are the differences between magnitude 8 and magnitude 6.8 in terms of, (i) Amplitude, (ii) Energy release, and (iii) peak ground acceleration (PGA)? **(10)**

$$M = 1 + (2/3)\, I_o$$

$$\log a = -\ 0.340 + 0.313\ I$$

$$V_p = \sqrt{\frac{(1-\nu)E}{(1-\nu-2\nu^2)\rho}}$$

$$V_s = \sqrt{\frac{G}{\rho}} = \sqrt{\frac{E}{\rho}\frac{1}{2(1+\nu)}}$$

$$P(M > m^*) = \frac{\exp(-t \cdot v_m(M > m^*))(t \cdot v_m(M > m^*))^n}{n!}$$

$$P(M > m^*) = 1 - \exp(-t \cdot v_m(M > m^*))$$